

# The Tao of Energy Revisited: Policy, Power Generation, and Air Quality in the Puget Sound/Georgia Basin Biosystem

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## Abstract

Permitting Sumas Energy 2 after its second application in 2002 would have benefited the environment and the energy situation in the Puget Sound/Georgia Basin Region by contributing 660 megawatts of energy and resulting in more restrictive NO<sub>x</sub> Best Available Control Technologies (BACT) for gas turbines in the United States. The U.S. has permitting processes pursuant to the Clean Air Act, such as Prevention of Significant Deterioration (PSD) and New Source Review (NSR), which are directly impacted by the BACT installed at each facility. Discussion will include the effects of existing gas-fired turbine in Sumas, Washington, on the downwind NO<sub>x</sub> concentrations. Consideration of wind direction, wind speed data, and temperature will be made with respect to the dispersion of aerosol pollutants and resultant photochemical oxidants. With this data the impacts of the criteria aerosol pollutants on human health will be made with discussion of the U.S. National Ambient Air Quality Standards (NAAQS).

## Preface

The following paper is intended as an extended abstract to my oral presentation given on April 2, 2003, at the Georgia Basin Ecosystem Initiative 2003 Spring Research Conference. I have written two other papers: one that addresses U.S. permitting policies for cogeneration power plants in depth and the other addresses regional power demand and the specifications of and controversy surrounding the proposed Sumas Energy 2 Generation Facility (S2GF). The latter was published in the Spring 2002 issue of *The Seed*, the University of British Columbia's undergraduate journal of Canadian Studies. Both are available upon request for additional background information. It is my hope that the following brings awareness to the complexity of the energy market and elucidates S2GF.

## The Tao of Energy

Tao is an ancient eastern philosophy that encompasses many principles. According to Western Reform Taoism "Tao refers to a power which envelops, surrounds and flows through all things, living and non-living. The Tao regulates natural processes and nourishes balance in the Universe. It embodies the harmony of opposites." This paper will consider two principles. First that everything has both positive and negative aspect, thus nothing is wholly good nor bad. The second is the search for truth.

Building a cogeneration power plant may nominally increase ambient air pollution, but raise standards so that future plants are cleaner and people have the power to meet their insatiable appetites, which is ever so important considering the decreasingly reliable hydro conditions as a result of climate change and population growth. Specifically, this paper will investigate the optimal utilization of policy in environmental protection with regards to the energy economy; contributions of aerosol pollutants to the Fraser Valley Airshed including those from the proposed Sumas 2 Generation Facility (S2GF) to be constructed in Sumas, Washington; as well as the health effects associated with the emissions from S2GF on the surrounding communities.

## Environmental Protection Through Permitting

As policy remains intrinsic to power generation, it is impossible to comprehensively discuss any aspect of energy generation without the inclusion of politics. Thus, this paper will commence with a brief discussion of the role policy plays in energy generation and environmental protection.

Policy can serve as a powerful tool for environmental protection when understood and implemented properly. In 1972 the United States introduced the Clean Air Act. From this, the U.S. Environmental Protection Agency developed Prevention of Significant Deterioration Permitting (PSD) and New Source Review (NSR) to regulate emissions from point sources. An extremely important component of these permitting processes is the function of Best Available Control Technology (BACT). For power plants this includes technologies such as oxidation catalysts and selective catalytic reduction (SCR). Each facility permitted sets a new precedence for BACT, meaning that any subsequent facility must implement comparable BACT or submit significant evidence of economic infeasibility. This is often referred to as "Top Down BACT." So how is this significant? This means that implementation of leading-edge control technology is promoted

through the permitting process. Permitting facilities with lower emissions and better technology raises the standards for facilities permitted after it.

The Clean Air Act also mandates the National Air Quality Standards (NAAQS). The NAAQS are intrinsic to NSR and PSD. NSR and PSD require thorough modeling emissions from the proposed facility, including ambient conditions. Thus, any proposed facility must not only meet BACT but must not result in the exceedence of the NAAQS in its surrounding communities. BACT regulates potential emissions where NAAQS regulates maximum regional emissions. BACT sets limits for single point sources, whereas NAAQS are designed to protect human health.

In recent years Canada has taken steps to implement Canada Wide Standards and the proposed National Ambient Air Quality Objectives. However, Canada has failed to set standards for point sources. This means that if Canadians, industry, or government really want it, a single source can be permitted with emissions that cause the airshed to reach the Canada Wide Standards. Such an act would bring regional growth to a screaming halt. Whereas Canada has not yet seen the same urban and industrial growth, in as many areas as the United States, perhaps Canada could extrapolate superior policy and growth management from the successes and failures of the United States. In order to not repeat errors, it is often prudent to examine history. Hence, regulation of both point source emissions and regional emissions is crucial to the protection of environmental and human health, as well as to ensure economic growth.

Table 1 lists the control technologies that will be implemented at S2GF to achieve the lowest reasonably achievable emissions and the corresponding permitted limits. Operating mode, operating load and other factors will determine actual emission rates. However, these are the emission limits legally imposed by the site certification agreement for the facility. In addition to these remarkable low emission limits, S2GF has voluntarily agreed to offset 100% NO<sub>x</sub> and PM emissions from the facility. This has not been taken into consideration in any analyses of the project.

**Table 1:** S2GF Best Available Control Technology.

*Data found in the S2GF site certification agreement issued by EFSEC*

Pollutant	Best Available Control	Emission Rate per Turbine
NO <sub>x</sub>	Dry low NO <sub>x</sub> combustor with SCR	2 ppm
SO <sub>2</sub>	Low-sulfur natural gas	1 ppm
CO	Turbine design, proper combustion, oxidation catalyst	2 ppm
PM	Low-sulfur natural gas, proper combustion	24 lb/hr
VOC	Combustion control, oxidation catalyst	6 ppm
Ammonia	Proper SCR operation	5 ppm

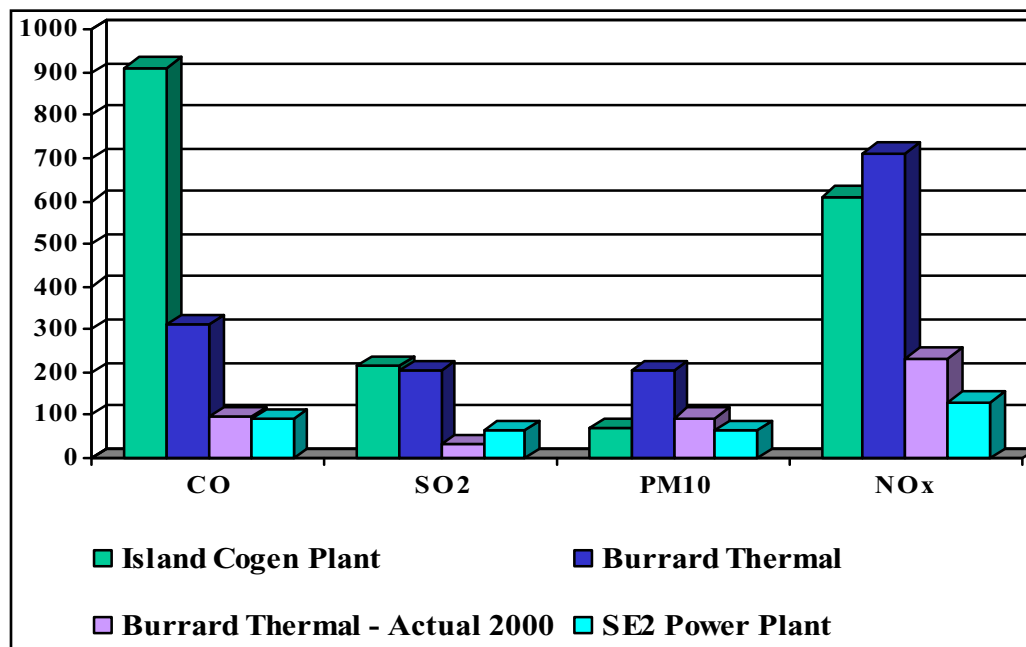
Even though permitting S2GF has raised standards for control technologies, it has taken 4 years and been subject to unprecedented opposition from the Canadian public. The following quote seems to accurately portray the magnitude of controversy that S2GF has faced:

“The battle over S2GF has been of an **UNPRECEDENTED** scale, testifying to the amazing unity of the people in the Fraser Valley and surrounding areas. **THOUSANDS** of ordinary people from all walks of life have participated in hearings, demonstrated at rallies, and spoken at meetings.”

~ Tuija Seipell

*Power to the People? Sumas 2 Power Plant*

No other plant in the region has met such opposition during the permitting process. The irony comes with the fact that S2GF is the cleanest proposed facility in Washington if not all of the U.S. and Canada. And it also makes one wonder when British Columbia recently permitted the Island Cogeneration Plant without the implementation of selective catalytic scrubbers or other advanced control technology. Below Figure 1 compares the maximum permitted emissions rates for Island Cogeneration Plant, Burrard Thermal and the proposed S2GF in tonnes per year. The actual annual emissions for Burrard Thermal have been included for comparison.



**Figure 1:** Maximum Permitted Emission Rates (tonnes/year).

*Data from the testimony of Mr. Eric Hansen of MFG to the National Energy Board*

Except for the actual emissions for Burrard Thermal, this data represents the potential environmental degradation from each facility. This is significant since each facility has the legal right at any time to emit the amount of each pollutant per its operating permit.

The most objective comparison would be to look at maximum emissions per unit of energy as displayed in Figure 2. The units are in kilograms per Megawatt-hour. Figure 2 shows just how “clean” each facility is compared to one another. It also eliminates the confusion created by different capacities, as well as actual versus permitted emissions. It seems curious that after S2GF received such protest from Canada that Canada has recently permitted the Island Cogeneration Plant which has much greater permitted emissions and emissions per unit of energy produced. Especially since one of the greatest arguments against S2GF was that the airshed could not handle any more pollution.

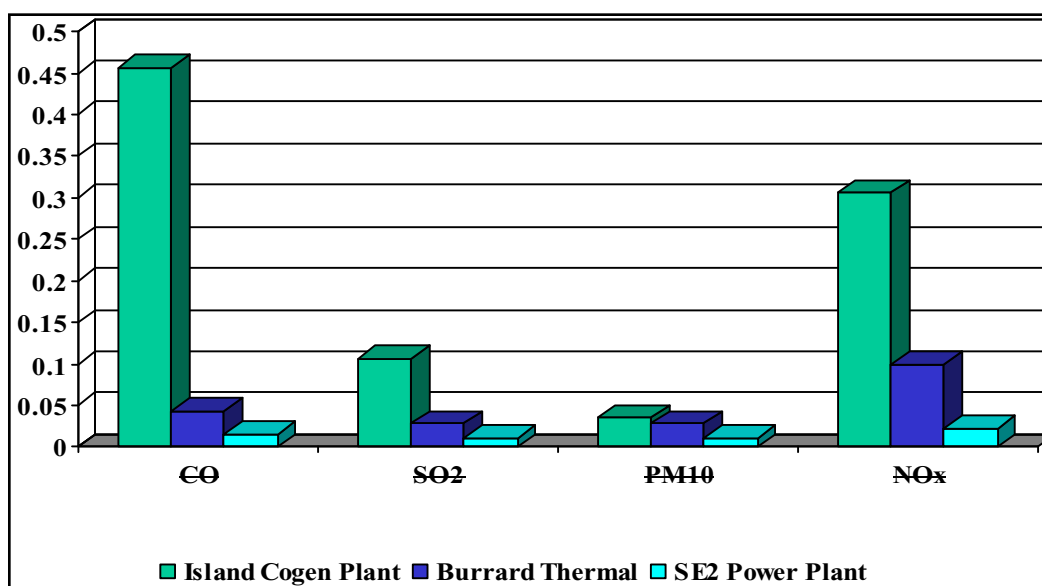
Below Table 2 displays the actual data for Figure 2.

**Table 2:** Maximum Emissions per Unit of Electricity Produced.

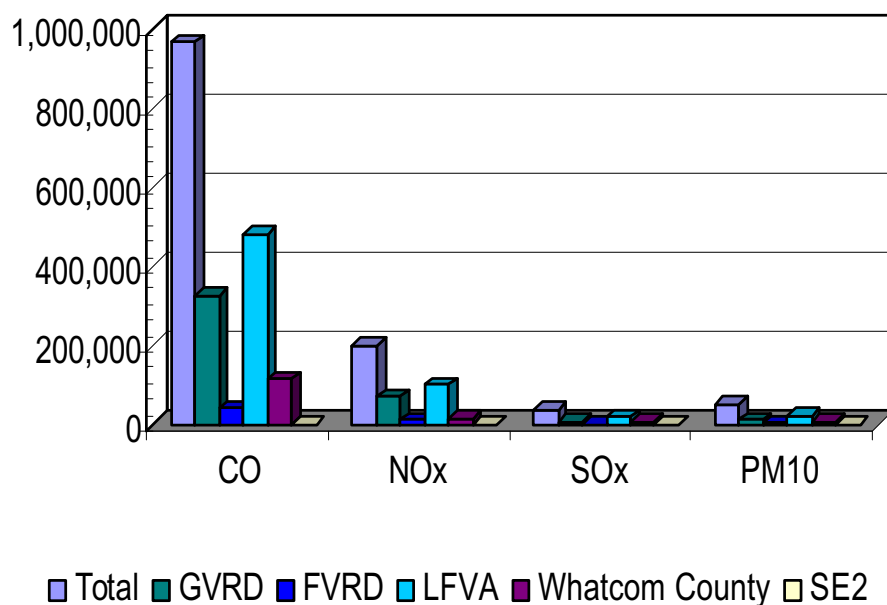
*Data from the testimony of Mr. Eric Hansen of MFG to the National Energy Board*

Gas-Fired Power Generation Facility	Generation Capacity (MW)	Emissions Per Unit of Electricity Produced (kg/MWh)			
		CO	SO <sub>2</sub>	PM <sub>10</sub>	NO <sub>x</sub>
Island Cogeneration Plant	245	0.456	0.107	0.035	0.306
Burrard Thermal Plant	960	0.044	0.029	0.029	0.100
SE2 Power Plant	660	0.016	0.011	0.011	0.023

The next two figures look at the contribution that S2GF would have on the Fraser Valley Airshed. The data was taken from the *2000 Emissions Inventory for the Lower Fraser Valley Airshed* released by the Greater Vancouver Regional District. Each figure looks at the total carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), sulfur oxides (SO<sub>x</sub>), and particulate matter less than 10 microns in diameter (PM<sub>10</sub>) emissions for the Fraser Valley Airshed. The totals are broken down into contributions from the Greater Fraser Valley Regional District (GVRD), the Fraser Valley Regional District (FVRD), the Lower Fraser Valley Airshed (LFVA), and Whatcom County in Washington State. The emissions from the proposed S2GF are included to graphically demonstrate its potential contribution to the Airshed. Below Figure 3 illustrates the regional annual emissions from all sources in tonnes per year.

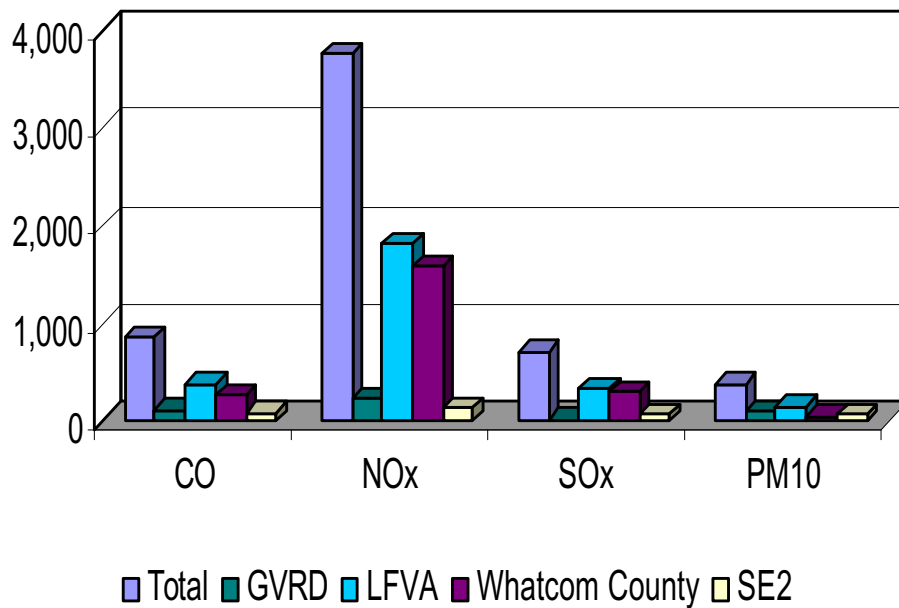


**Figure 2:** Maximum Emissions per Unit Electricity Produced (kg/MWh).  
Data from the testimony of Mr. Eric Hansen of MFG to the National Energy Board



**Figure 3:** Regional Annual Emissions (tonnes/year).  
Data from the 2002 Emission Inventory for the Lower Fraser Valley Airshed published by the Greater Valley Regional District

Finally, Figure 4 isolates the regional annual emissions from power generation alone. Power generation accounts for 8% of CO, 2% of NO<sub>x</sub> and SO<sub>x</sub>, and 0.6% of PM<sub>10</sub> emissions for the region. Clearly even when considering such a small portion of the region's emissions, S2GF would represent a nominal contribution.



**Figure 4:** Regional Annual Emissions from Power Generation.

*Data from the 2002 Emission Inventory for the Lower Fraser Valley Airshed published by the Greater Valley Regional District*

### Health Effects from S2GF

On December 23, 2002, Cantox Environmental, of Calgary, Alberta, issued a report assessing the potential human health risks associated with the emissions from S2GF. This report was included as testimony to the Canadian National Energy Board supporting the issuance of permit for installation of a 230 kV transmission line connecting the proposed S2GF to the power grid at the BC Hydro and Power Authority Clayburn Station near Abbotsford. Cantox Environmental based their methodology on recommendations from various leading scientific and regulatory agencies including The British Columbia Ministry of Water, Land and Air Protection; Health Canada; The Canadian Council of Ministers of the Environment; and the United States Environmental Protection Agency. Additionally Cantox included a high level of conservatism in their modeling. CALPUFF, CALMET, and ISC modeling have been conducted for S2GF with over 500,000 scenarios.

In short, the modeling “demonstrated an overall lack of health risks from the S2GF, not only when considered on a project-specific basis, but even on a cumulative basis [which includes ‘background’ emissions]. The study found no significant basis for anticipated acute health risks or chronic health risks to the communities of Abbotsford, Chiliwack, Hope, Surrey, or the communities on Sumas Mountain.”

Cantox Environmental noted these findings as remarkable considering the level of conservatism employed. The analysis considered the Canadian National Ambient Air Quality Objectives, which are endorsed by the Canadian Council of Ministers of the Environment. Regardless of operating conditions, receptor location, dispersion model, or exposure scenario failed to present a health risk under the more stringent of the NAAQS or NAAQO. The report also concluded that: “The absence of demonstrated health risks applies to the vast majority of people, even to individuals who may be overly sensitive to air pollution, either intrinsically or because of age or health status.”

### In Search of Truth

It is true that building S2GF will result in a nominal increase in the region’s emissions of aerosol pollutants. However, issuance of permit for the facility has raised public awareness and increased the standards for future cogeneration facilities. It is clear that the Fraser Valley Airshed is in poor condition. However, adding S2GF may in effect improve the region’s air quality. How is this possible? First, now that the public has a greater awareness of pollution for point sources it will demand lower emissions. S2GF will raise the standards for emissions from cogeneration power plants in the United States and may prompt Canada to protect public health and economic growth by setting emission standards for point sources. Additionally, S2GF has set precedence by willingly agreeing to offset its NO<sub>x</sub> and PM emissions by 100%.

Thus, the positive and negative aspects. Nominal regional emissions increases balanced by higher standards, emissions offsets, public awareness, and affordable power for future use.

**The Truth.** Emissions S2GF will not impose acute or chronic health risks on a project specific or cumulative basis, even to susceptible members of society. Thus dear reader, you have witnessed a piece of the complexity of the Tao of Energy.

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